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(54) Title: CHANNEL EVACUATION PROCEDURES FOR WIRELESS NETWORKS DEPLOYED IN DYNAMIC SHARED SPECTRUM

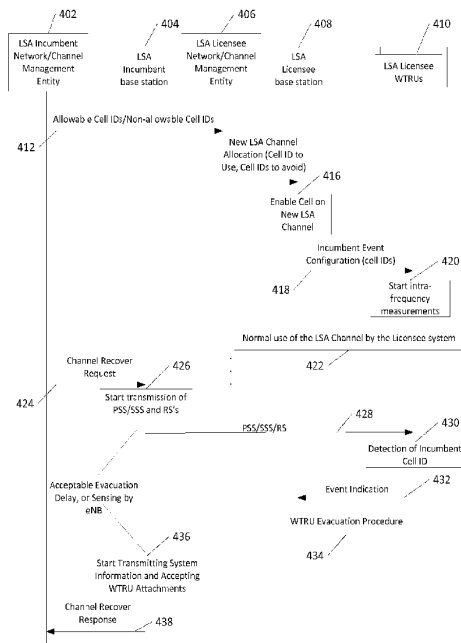


FIG. 4

(57) Abstract: Systems, methods, and instrumentalities are described for channel evacuation of a shared spectrum channel. A secondary user base station may provide one or more secondary user wireless transmit receive unit (WTRUs) access to a shared spectrum channel. The secondary user base station may receive an evacuation message indicating a need for the secondary user WTRUs to evacuate the shared spectrum channel. The secondary user base station may coordinate channel evacuation of the shared spectrum channel in response to the evacuation message. A secondary user WTRU may detect an incumbent user. The secondary user WTRU may receive an incumbent detection measurement configuration. The secondary user WTRU may detect whether an incumbent user is present on a shared spectrum channel and may send a detection message upon detection of the incumbent user. The secondary user WTRU may receive a reconfiguration message in response to the detection message.

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**CHANNEL EVACUATION PROCEDURES FOR WIRELESS NETWORKS  
DEPLOYED IN DYNAMIC SHARED SPECTRUM**

**CROSS REFERENCE TO RELATED APPLICATIONS**

**[0001]** This application claims the benefit of U.S. Provisional Patent Application No. 61/726,871 filed November 15, 2012, the contents of which are hereby incorporated by reference herein.

**BACKGROUND**

**[0002]** When a wireless system operates in a secondary fashion in dynamic shared spectrum (DSS), it may allow usage of the spectrum to a system which has a higher usage priority for the spectrum. Such higher priority systems may include primary users (PU) in Television White Space (TVWS), or Licensed Shared Access (LSA) incumbents in case of the spectrum under the LSA regime.

**[0003]** To operate in DSS such as TVWS, the devices (e.g., complying with regulatory requirements) may benefit by gaining access to free channels. In major cities that have limited or no TVWS channels available, sensing only operation may become essential as a means to gain access to more channels. Below roof line deployments, for example, may benefit from the isolation brought by the urban landscape from the digital TV (DTV) transmitters. Further, indoor deployments may benefit from the indoor penetration loss. In this context, sensing only operation may comply with specific requirements on Spectrum Sensing allowing a small cell network to make use of a PU-assigned channel. The PU-Assigned channel (e.g., assigned to a primary user) may require a secondary user (SU) to leave the channel, if the primary user is detected. Similarly, the LSA regime may ensure the protection of the LSA incumbent to interference from the LSA licensee, as well as a guarantee that the LSA incumbent has prioritized access to the spectrum that the incumbent owns and sublicenses. The connected

mode mechanisms may be needed to provide support for PU detection, reporting and/or channel evacuation, e.g., when a system operates on DSS spectrum in a secondary fashion.

#### **SUMMARY OF THE INVENTION**

**[0004]** Systems, methods, and instrumentalities are described for channel evacuation of a shared spectrum channel. In shared spectrum, a secondary user system may use spectrum. The spectrum may be utilized and/or controlled by an incumbent system. A secondary user base station may provide one or more secondary user wireless transmit receive unit (WTRUs) access to a shared spectrum channel. The secondary user base station may include, but not limited to, a licensed shared access (LSA) licensee base station, a TVWS base station, a dynamic shared spectrum access point and/or the like.) The secondary user base station may receive an evacuation message indicating a need for the secondary user base station and WTRUs to evacuate the shared spectrum channel. The evacuation message may include an alternate channel for use by the secondary user WTRUs. The evacuation message may include a system evacuation message. The secondary user base station may receive the evacuation message from a database entity or a broker entity. The secondary user base station may check the status of a shared spectrum channel with a database or a broker to determine the need to evacuate the shared spectrum channel. The secondary user may receive an evacuation message in response to the shared spectrum channel status check.

**[0005]** The secondary user base station may receive the evacuation message from a management entity, e.g., based on a pre-determined channel evacuation time. The pre-determined channel evacuation time may be based on an agreement between an incumbent system operator and a secondary user operator. The allowable use of the channel by the secondary system may be periodic. The evacuation time may re-occur one or more times. The pre-determined evacuation time may be based on an allowed time for the use of the shared spectrum channel by the secondary user WTRUs. The shared spectrum channel may be an LSA channel.

**[0006]** The secondary user base station may coordinate channel evacuation of the shared spectrum channel in response to the evacuation message. The secondary user base station may send an evacuation complete message to an incumbent user (e.g., an incumbent base station). The incumbent user may be the primary user (PU). The evacuation complete message may indicate to the incumbent user that the evacuation of the shared spectrum channel has been completed. The system evacuation message may comprise an X2 message received via an X2 interface. The secondary user base station may select a target cell, e.g., based on at least one of

an event notification, a secondary user WTRU measurement report, or an neighbor relational table (NRT) entry. The secondary user base station may send a handover request to the target cell.

**[0007]** The secondary user base station may send a measurement event configuration to the secondary user WTRUs. The measurement event configuration may include at least one of a public land mobile network identifier (PLMN ID) or a request for performing a PLMN search on the shared spectrum channel based on the PLMN ID. The PLMN ID to be search may be associated with an incumbent user. The secondary user WTRU's may be asked to trigger an event notification to the secondary user base station, e.g., when the PLMN ID is detected following configuration of the measurement event. An evacuation message may be received in response to the notification. .

**[0008]** A secondary user WTRU may detect an incumbent user (e.g., operating on the shared spectrum channel). The secondary user WTRU may receive an incumbent detection measurement configuration. The incumbent detection measurement configuration may include an incumbent cell identifier (ID) (e.g., one or more of a physical cell identifier (PCI) or a PLMN ID) associated with the incumbent user.

**[0009]** The secondary user WTRU may detect whether an incumbent user is present on a shared spectrum channel, e.g., based on the incumbent detection measurement configuration. The secondary user WTRU may send a detection message upon detection of the incumbent user. The detection message may be sent via an uplink incumbent user detection media access control (MAC) control element (CE) or via a radio resource control (RRC) message. The detection message may include an event notification. The event notification may indicate the presence of the incumbent user. The secondary user WTRU may receive an evacuation message from the secondary user base station in response to the detection message.

**[0010]** The secondary user WTRU may receive a reconfiguration message in response to the detection message. The reconfiguration message may include an identification of a target cell. The secondary user WTRU may update its radio resource configuration based on the received reconfiguration message. The secondary user WTRU may send a reconfiguration complete message to the target cell.

**[0011]** The secondary user WTRU may start a timer with a value upon the detection of the incumbent user. The value of the timer may be assigned in such a way to stagger the connection request. The secondary user WTRU may send a connection request to a target cell upon an expiry of the timer.

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